

Climate of Oregon

Introduction

This publication consists of a narrative that describes some of the principal climatic features and a number of climatological summaries for stations in various geographic regions of the State. The detailed information presented should be sufficient for general use; however, some users may require additional information.

The National Climatic Data Center (NCDC) located in Asheville, North Carolina is authorized to perform special services for other government agencies and for private clients at the expense of the requester. The amount charged in all cases is intended to solely defray the expenses incurred by the government in satisfying such specific requests to the best of its ability. It is essential that requesters furnish the NCDC with a precise statement describing the problem so that a mutual understanding of the specifications is reached.

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The Means and Extremes of meteorological variables in the Climatography of the U.S. No.20 series are recorded by observers in the cooperative network. The Normals, Means and Extremes in the Local Climatological Data, annuals are computed from observations taken primarily at airports.

The editor of this publication expresses his thanks to those State Climatologists, who, over the years, have made significant and lasting contributions toward the development of this very useful series.

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Topographic Features- Oregon enjoys a mild, though varied climate with only a rare occurrence of devastating weather elements such as cloudbursts, tornadoes or hailstorms severe enough to cause serious widespread damage. The single most important geographic feature of the climate of Oregon is the Pacific Ocean whose coastline makes up the western border. Because of the normal movement of air masses from west to east, most of the systems moving across Oregon have been modified extensively in traveling over the Pacific. As a result, winter minimum and summer maximum temperatures in the west, and to a lesser extent in the eastern portion, are greatly moderated. The occurrence of extreme low or high temperatures is generally associated with the occasional invasion of continental air masses. The unlimited supply of moisture available to air masses that move across the Pacific is largely responsible for the abundant rainfall over western Oregon and the higher elevations of the eastern portion.

Beginning near and following the coast the full length of the State, the Coast Range is the farthest west of the three mountain ranges that exert an important influence on Oregon's climate. This range rises to between 2,000 and 3,000 feet above sea level in the northern part of the State and between 3,000 and 4,000 feet in the southern portion with occasional peaks rising another 1,000 to 1,500 feet. This range, athwart the path of the moisture-laden marine air moving in from the Pacific, forces it to rise as it moves eastward. The resultant cooling and condensation produces some of the heaviest annual rainfalls in the United States along the higher western slopes, and materially reduces the available moisture in the air.

The Cascade Mountains parallel the Coast Range about 75 miles to the east and to within 50 to 75 miles of the California border where the two ranges merge, forming a fairly broad, rugged mountain chain known as the Rogue River Mountains. The Cascades rise from the broad valley of the Willamette eastward to an average height of about 5,000 feet, with a few peaks over 10,000 feet. One of these, Mount Hood, at an elevation of 11,239 feet, is the highest point in the State. Once again, the air masses from the west are forced to ascend causing them to give up additional moisture. The rain potential of the marine air, however, was greatly reduced by passage over the Coast Range; therefore, the rainfall on the west slopes of the Cascades at a corresponding elevation is only about one-half to two-thirds as great as on the Coast Range. Precipitation amounts decrease rapidly once the crest is crossed and descent down the eastward side begins.

The Blue Mountains extend from the northeast corner southwestward to the valleys of the John Day and Deschutes rivers in central Oregon. Part of the chain projects southeast to the Snake River valley, while in the northeast a separate branch is known as the Wallowa Mountains. These mountains, roughly between 5,000 and 6,000 feet with peaks from 7,000 to 9,000 feet, also exert an influence on the climate in the immediate area including several sizable valleys, particularly those of the Umatilla and Grand Ronde rivers. However, the overall effect is much less than that of either the Coast or Cascade ranges. These mountains are the source of a number

of small streams used for irrigation and power production. They are also in an area of fairly heavy snowfall which provides excellent skiing. The snowmelt maintains the steady and reliable water flow necessary for fine trout and salmon streams.

The Steens Mountains are a short range in the southeast part of the State less than 25 miles in length and only a very local climatic significance. The main crest is slightly more than 8,000 feet above sea level, with one peak of 9,354 feet. They serve as a snow shed that feeds several small streams useful to local irrigation. Most important of these is the Donner und Blitzen River.

The Columbia River is of vital economic importance to the State, since the large dams along its course generate most of the hydroelectric power in the Northwest. Its waters are used to irrigate thousands of acres of rich agricultural land in the Boardman and Portland areas. As a major waterway it carries millions of tons of shipping hundreds of miles inland each year. The ports of Vancouver on the Columbia, and Portland on the Willamette at its confluence with the Columbia, are among the finest and largest fresh water ports in the world. Cutting through both the Cascade and the Coast Ranges, the Columbia Gorge offers ready passage of marine air from the Pacific. Temperatures are moderated to the east in both summer and winter. Continental air occasionally passes in reverse and produces the more extreme low temperatures in the western valleys.

Winding through the rugged terrain that makes up much of Oregon are the Columbia and Snake river basins, the valleys of the many streams that head in the mountains and several very wide plateau regions. The valleys, particularly those of the Columbia, Snake, Willamette, Rouge and Hood Rivers, produce most of Oregon's agricultural wealth; however, the mountain and plateau regions are used extensively for livestock grazing and dryland farming. The Columbia Plateau covers about two-thirds of the State's total area and extends from the eastern border westward to the eastern slopes of the Cascade Mountains and from the southern border north to the Columbia River. Its elevations ranges from 4,000 to 6,000 feet and because of its arid nature and scant vegetation, summer heating and winter cooling often become extreme.

The State is divided into six major agroclimatic areas:

- 1) Coastal and Lower Columbia (Clatsop, Columbia, Coos, Curry, Lincoln and Tillamook counties): This is a heavily timbered area with copious rainfall much of the year resulting in lush pastures, largely responsible for the predominance of dairying in these counties. Along the lower Columbia and in the northern Coastal valleys production of grass seed, flower bulbs, cranberries and milk add significantly to the farm income. In the southern coastal counties, in addition to dairy and meat production, substantial supplements to the farm income include wool, cranberries, legumes, seeds, nuts, fruit, strawberries, and a large lily bulb and cut flower industry.
- 2) Willamette Valley (Benton, Clackamas, Lane, Linn, Marion, Multnomah, Polk, Washington and Yamhill counties): This is by far the most diversified agricultural area in the State. Its climate is relatively free of extremes in temperatures; growing seasons are long, and moisture is abundant most of the year, although summer irrigation is used. There are extensive commercial productions of hay, grain, truck

crops, apples, pears, sweet cherries, hops, onions, potatoes, mint, flax, vegetables, specialty grass seeds and many other miscellaneous crops. Other farm operations include dairying, poultry raising and extensive nurseries.

- 3) Southwestern Oregon (Douglas, Jackson and Josephine counties): This region is best known for the Rouge River pear industry. Fruit growing, dairying, the growing of hay, grain and seed crops, and raising beef cattle, poultry and sheep are economically important. The growing of bulbs and hops adds substantially to the agricultural economy.
- 4) Columbia Basin (Gilliam, Hood River, Morrow, Sherman, Umatilla, Wasco and Wheeler counties): This is Oregon's major wheat producing area. Grain, raised on dryland farms and fruit farming are the main source of farm income in these counties. Fruits are also raised commercially in counties adjacent to the Columbia River. Truck crops raised under irrigation are important. Additionally, cattle, sheep, alfalfa and poultry make substantial contributions to the agricultural wealth of the region.
- 5) South Central Oregon (Crook, Deschutes, Grant, Harney, Jefferson, Klamath and Lake counties): This region is primarily livestock country with vast spring, summer and fall ranges. In addition to beef cattle, which are the dominant livestock interest, there is also extensive raising of sheep, dairy herds, horses and swine. Field crops grown on commercial basis include potatoes, alfalfa, wheat, oats, barley and onions.
- 6) Snake River Basin (Baker, Malheur, Union and Wallowa counties): Livestock raising is a major industry. While beef cattle predominate, sheep, dairy herds, hogs and poultry are all important contributors to the farm income. In most of these counties the principal crops are wheat, potatoes, barely, oats and grass seed. In addition to crops already mentioned, this county produced large acreages of sugar beets, onions, peas, tomatoes, berries, sweet corn and miscellaneous crops.

Temperature- Few states have greater temperature extremes than Oregon where they have ranged from a low of -54 degrees Fahrenheit (° F) to a high of 119° F. Seldom, however, do daily extremes occur even closely approaching these absolute records. Specifically for Portland, January averages 40 while the July average is 68° F. Temperatures of 90° F or greater occur about 13 days annually. In the inland valleys of the southwest the average summer temperatures are about five degrees higher than in the northwest and maximums of 90° F or higher occur 40 to 50 days a year. In south-central Oregon the median annual maximum temperatures are between 95 and 100; in most other areas east of the Cascades this variance is between 100 and 105° F. Median annual minimum temperatures for eastern Oregon vary from near zero Fahrenheit in the more protected areas of the Columbia Basin to nearly -30° F in the high mountain and plateau regions. The minima for majority of these stations, however, lie in -1 to -10° F range. The normal mean January temperature in southeast Oregon is 25 to 28 while in the northeast it is 29 to 33° F; July normal means range from 65 to 70 in the central valleys and plateau regions and 70 to 78° F along the eastern border.

Precipitation- The average annual rainfall in Oregon varies from as much as 200 inches at points long the upper west slopes of the Coast Range to less than eight inches in Plateau regions. Accordingly, vegetation ranges from the heavily wooded Coast Range and west slopes of the Cascades with their dense undergrowth to only a very sparse growth of sagebrush and desert type grasses over the wide plateau areas of central Oregon.

The State as a whole has a very definite winter rainfall climate. West of the Cascades about one-half of the annual total precipitation falls from December through February; about one-fourth in the spring and fall and very little during the summer months. East of the Cascades the differences are not as pronounced with slightly more precipitation in winter than in spring and fall, while only about 10 percent falls during the summer. Along the coast the normal annual total is from 75 to 90 inches, and increases up the west slopes of the Coast Range to almost 200 inches near the crest. Amounts decrease on the eastern slopes and in the Willamette Valley. On the western slopes of the Cascades there is again a marked increase in precipitation with elevation as annual averages range up to 75 inches. Amounts decrease rapidly on the east side. The annual average precipitation for the great plateau of the State is often less than eight inches. In the Columbia River Basin and the Blue Mountains, totals are about 15 to 20 inches; however, some of the mountain regions receive as much as 35 inches.

The State's heaviest snowfalls occur in the high Cascades. Annual average totals can range from 300 to 550 inches. An annual snowfall of approximately 900 inches (82.5 feet) and a snow depth of 252 inches (21 feet) have been recorded at Crater Lake National Park Headquarters. Winter precipitation along the Coast Range, due to its lower elevations, occurs largely in the form of rain, although it too is occasionally subject to very heavy snows. In the Blue Mountains, seasonal totals range between 150 to 300 inches and depths on the ground may occasionally exceed 120 inches. The periods of continuous snow cover vary with elevation. On the peaks of the Cascades higher than 7,000 feet above sea level it persists in glacial form the year around. In most mountain areas above 4,500 feet snow cover lasts from early December until the latter part of April. Above 4,500 feet, snow depths (again varying with elevation) are approximately 50 to 100 inches in the Cascades, 25 to 65 inches in the Blue Mountains at the end of January; 60 to 125 inches and 25 to 70 inches, respectively, at the end of February; 75 to 135 inches and 25 to 80 inches at the end of March; 40 to 120 inches and five to 45 inches at the end of April.

Along the coast the average annual snowfall is only one to three inches, with many years in which there is no measurable amount. In the inland western valleys most yearly totals average between 10 to 15 inches, with snow on the ground seldom lasting more than two to three days at a time. In north-central Oregon the annual average is 15 to 30 inches, while over the higher plateau region that makes up the south-central portion snowfall ranges up to as much as 60 inches. In the valleys of the northeast 40 to 75 inches is normal, while in the Snake River Basin which makes up most of the southeast it is only 15 to 40 inches. Every few years some part of the State will receive 20 to 25 inches of snow in a 24-hour period.

Hailstorms occur each year, but are generally light and cover very small areas. They cause damage annually to crops, vehicles and buildings. Practically all of these storms occur east of the Cascades. In the western part of the State, thunderstorms occur in the valleys an average of four to five days a year and are not usually severe. In the eastern part, they occur on 12 to 15 days with heavier precipitation and greater wind damage; however, total losses are not extensive.

It is in the mountain areas that these storms occur most frequently and each year many forest fires are started by lightning.

Several times each year winds of hurricane force (74 mph and higher) strike the Oregon coast. They sometimes move inland to the western valleys and up the Columbia Gorge. Damage is usually confined to power and communication lines, to some crops, and to outdoor signs and timber. Very rarely does loss of life or major structural damage to buildings result. The annual average is one tornado. The prevailing wind direction is influenced by the surrounding terrain. In the Columbia Gorge for example, the prevailing direction of the wind follows the orientation of the gorge at that point. Similarly, in the Willamette Valley prevailing directions are aligned north-south with the valley. The very strong winds, of course, are determined by the directions of the major storm movements. The fastest winds are generally from the south or west. Light winds greatly outnumber the strong storm winds, and mountain slopes and other topographic features influence their direction.

Most of the State is drained into the Pacific Ocean through the Columbia River. Major tributaries to the Columbia include the: Willamette draining both the east slope of the Coast Range and the west slope of the Cascades; Deschutes; John Day; Umatilla and Snake rivers. The Snake makes up more than half of Oregon's eastern border and drains practically all the State east of the Blue Mountains. The west slope of the Coast Range and all areas south of the Willamette Basin and west of the summit of the Cascades are drained directly into the Pacific Ocean by three large river systems – the: Umpqua, Rogue and Smith rivers along with a number of smaller coastal streams. The only major river draining south central Oregon is the Klamath. The remainder of the area lying south of the Deschutes and John Day basins and between the Cascades and the Blue Mountains has only internal drainage into brackish lakes. Many of these lakes become dry during the summer months.

Major flooding in the Willamette Basin and the coastal streams usually results from several days of moderate to heavy rain extending over the entire Basin. When combined with sharply rising air temperatures and a warm southerly wind, the melting of a heavy snow pack on the middle and upper slopes of the Coast Range and/or the Cascades greatly increases the flood potential. Flooding in the main channel of the Columbia River usually occurs during late spring and early summer when snowmelt in the mountains is most rapid. Simultaneous occurrences of heavy, warm rain over large parts of the Columbia Basin, on occasion, produced some very damaging floods. The Columbia and Willamette rivers have many large multiple-purpose dams as an aid in flood control.

During the early morning hours the relative humidity is greatest and there is little variation at this time between winter and summer readings in eastern and western Oregon. The 4:30 a.m. average for practically every station in the State from which relative humidity figures are available is between 82 and 92 percent in January and only about five percent less in each case in July. In contrast, the 4:40 p.m. averages, when the relative humidities are least, show a very marked difference between summer and winter and also between the areas east and west of the Cascades. The afternoon average relative humidity ranges between 75 and 85 percent in January, while in July this drops to 25 or 30 percent east of the Cascades and slightly higher on

the western side. Relative humidities of 10 to 20 percent often occur under extreme conditions during the summer and early fall.

The average dates of the last 32° F temperature in the spring and the first in fall are used to determine the average length of the growing season. A temperature that is very critical to one type of vegetation may not be damaging to others. The length of the growing season is extremely variable and depends primarily on elevation and latitude. This period ranges from less than 50 to almost 300 days.

From May through September 80 to 90 percent of annual evaporation takes place with a range from 18 to 46 inches.

The north coastal area has the least sunshine, while the southeast corner of the state the most. During January, the sun will shine about 20 percent of the time possible in the coastal area and 45 percent of the time possible in the southeast. These values increase in April to values of 50 to 70 percent; in July to 55 percent the northwest and 90 percent in the southeast; and by October have declined to 40 and 65 percent, respectively.

Climate and the Economy- Oregon's economy is very closely tied to its climate, with regard to its industry, agriculture and recreation. The mild temperatures and abundant rainfall on the middle and upper slopes of the Coast Range and the Cascade Mountains make this one of the fastest tree growing areas in the nation. Numerous board feet of Douglas fir and pine are harvested each year. Lumbering and the manufacture of related forest products are important industries for the State. The heavy sustained runoff from the high elevations makes it possible to generate vast quantities of hydroelectric power.

Agriculture in Oregon is as varied as the climate that sustains it. Although annual precipitation ranges from less than 10 inches to more than 60 inches, the principal crop areas have one thing in common – their very predominate winter rainfall climate. There are years when the combined July and August total over the entire State averages only a quarter of an inch or less and the normal in the eastern part of the State for these two months is less than an inch. Despite this, a very wide range of crops are grown here. Because of the frequency of dry summers, agricultural crops and practices are planned accordingly.

The most damaging drought condition is a very marked deficiency of rainfall during spring and early summer. It is needed then to complete maturity of hay and grain, and to bring on range forage. Seldom has the lack of moisture been severe enough to cause a complete crop failure over any sizable area. It does occasionally reduce crop yields and quality and force ranchers to put livestock on the market before the stock has reached prime conditions.

The heavy winter precipitation in the mountain areas also provides an abundant water supply for irrigation. The dams that generate hydroelectric power, and others as well, are used to store winter rainfall for summer irrigation. Several private irrigation districts formed and an extensive system of canals built to bring water from reservoirs and streams to previously semi-desert land. In many areas, deep wells have been dug.